



***Zyzyzus rubusidaeus* (Cnidaria, Hydrozoa, Tubulariidae), a new species of anthoathecate hydroid from the coast of British Columbia, Canada**

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Abstract

Zyzyzus rubusidaeus, **sp. nov.**, is described from inshore waters near the northern tip of Vancouver Island, British Columbia, Canada. Specimens were collected on rocky bottoms amongst barnacles, sponges, and compound ascidians at a depth of 18 m in Weynton Passage, Broughton Strait, during March, July, and October 2012. Polyps tend to grow in dense aggregations, often covering several square centimetres. Hydroids of *Z. rubusidaeus* most closely resemble those of *Z. robustus* Petersen, 1990 from Greenland, but differ in having aboral tentacles that are scattered in a narrow band around the base of the hydranth rather than occurring in a single whorl, thin and transparent instead of thick and stiff perisarc around hydrocaulus and tubers, and gonophores that arise from simple pedicels instead of short, stout branches. Possible embryos were present in female gonophores, although structures recognizable as actinula larvae have not been observed. The cnidome comprises small and large stenoteles, desmonemes, microbasic euryteles, basitrichs, and isorhizas. Polyps are a raspberry colour in life, a hue that has faded but little in our formalin-preserved material. Discovery of this hydroid brings the number of species currently recognized in genus *Zyzyzus* Stechow, 1921 to seven.

Key words: Anthoathecata, Capitata, Hydroidolina, invertebrates, marine biology, natural history, taxonomy, zoology

Introduction

Zyzyzus Stechow, 1921 is a relatively obscure genus of hydrozoans, currently referred to family Tubulariidae Fleming, 1828. Within that group it is closely related to *Ralpharia* Watson, 1980 (Nawrocki & Cartwright, 2012), another little-known hydroid genus. Its type species, by monotypy, is *Tubularia solitaria* Warren, 1906 (not *Tubularia solitaria* Rapp, 1829, now known to be an anthozoan; the permanently invalid junior primary homonym *T. solitaria* Warren, 1906 has been replaced by the name *Zyzyzus warreni* Calder, 1988). Species assigned thus far to the genus are strictly polypoid, with an actinula stage instead of a medusa in the life cycle. Although infrequently reported, hydroids included in *Zyzyzus* have now been discovered in all oceans.

Previously known species of *Zyzyzus* are said to be solitary, as with certain other representatives of the clade Aplanulata Collins, Winkelmann, Hadrys & Schierwater, 2005, although they may occur in aggregates and appear colonial. Sponges are their most frequently reported substrate (Petersen 1990; Puce *et al.* 2005; Campos *et al.* 2007, 2012) but they have been reported on others as well (e.g. Calder 1988; Petersen 1990). Polyps of the genus are distinguished by a combination of characters: hydrocauli are stout and parenchymatous, with peripheral longitudinal canals in the endoderm; hydrorhizae are in the form of rootlets and tubers; hydranths are radially symmetrical, with oral and aboral whorls of tentacles; actinula-forming gonophores occur on blastostyles arising just distal to the aboral tentacles.

In a revision of the genus *Zyzyzus*, Campos *et al.* (2007) recognized four species as valid: *Z. warreni*, with a widespread distribution in warm waters of the Atlantic, Pacific, and Indian oceans, *Z. spongicolus* (von Lendenfeld, 1885) from Australia, *Z. floridanus* Petersen, 1990 from Florida, and *Z. robustus* Petersen, 1990 from Greenland. Campos *et al.* referred *Z. calderi* Petersen, 1990 from Bermuda to the synonymy of *Z. warreni*. Hirohito (1988) suggested that *Corymorpha iyoensis* Yamada, 1958 from Japan should be assigned to the genus. The generic

identity of *Corymorpha balssi* Stechow, 1932 from Australia is unclear, although Watson (2008) suspected that it might also be referable to *Zyzyzus*. Six species assigned to the genus have been listed as valid in the World Hydrozoa Database (Schuchert 2013): *Z. floridanus*, *Z. iyoensis*, *Z. robustus*, *Z. spongicolus*, and *Z. warreni*, as well as *Z. parvula* (Hickson & Gravely, 1907) from Antarctica.

Hydroids of a species assigned here to *Zyzyzus*, from coastal British Columbia, Canada, were recently brought to our attention by biologist and underwater photographer Neil McDaniel. These hydroids possess a unique combination of characters in the genus, and are described as a new species herein. Type material has been deposited in invertebrate zoology collections at the Royal Ontario Museum (ROMIZ), Toronto, Ontario, and the Royal British Columbia Museum (RBCM), Victoria, British Columbia.

Systematic account

Phylum Cnidaria Verrill, 1865

Subphylum Tesserazoa von Salvini-Plawen, 1978 (Medusozoa Petersen, 1979)

Class Hydrozoa Owen, 1843

Subclass Hydroidolina Collins, 2000

Order Anthoathecata Cornelius, 1992

Suborder Capitata Kühn, 1913

Clade Aplanulata Collins, Winkelmann, Hadrys & Schierwater, 2005

Family Tubulariidae Fleming, 1828

Genus *Zyzyzus* Stechow, 1921

***Zyzyzus rubusidaeus*, sp. nov.**

Tubulariidae.—Millen, 1985: 15.

Corymorpha sp.—Harbo, 1999: 32; 2011: 46.—Austin, 2000: 58, 60, 62, 63.

Material examined. Holotype: Kuldekduma Island, Weynton Passage, Broughton Strait, British Columbia, Canada, 50°35.299'N, 126°50.046'W, depth 60 feet (18 m), 30 March 2012, on rock amongst barnacles and sponges, mature polyp, 2.5 cm high (preserved in 4% formaldehyde; specimen part of a larger aggregation covering about 8 cm²), with female (?) gonophores, coll. Neil McDaniel, ROMIZ B3957.

Paratypes: Kuldekduma Island, Weynton Passage, Broughton Strait, British Columbia, Canada, 50°35.299'N, 126°50.046'W, depth 60 feet (18 m), 30 March 2012, on rock amongst barnacles and sponges, several mature and juvenile polyps (part of the same aggregation that included the holotype), adults with female gonophores, coll. Neil McDaniel, ROMIZ B3958.—Kuldekduma Island, Weynton Passage, Broughton Strait, British Columbia, Canada, 50°35.299'N, 126°50.046'W, depth 60 feet (18 m), 30 March 2012, on rock amongst barnacles and sponges, mature and immature hydranths (part of the same aggregation that included the holotype), coll. Neil McDaniel, RBCM 2012-00234-001.

Additional material: Pearse Reefs, Weynton Passage, Broughton Strait, British Columbia, Canada, depth 60 feet (18 m), 23 July 2012, several mature and juvenile polyps, adults with female gonophores, coll. Steve Lacasse, ROMIZ B3959.—Plumper Island, Weynton Passage, depth 60 feet (18 m), 9 October 2012, several polyps, all male, coll. Steve Lacasse, RBCM 012-00277-001.

Description (Figs. 1–4). Hydroids occurring in colony-like aggregations of polyps composed of adults and numerous juveniles in all stages of development; adults up to 5 cm high and 5 mm wide (hydranth body without

tentacles; preserved specimens). Aggregations varying from those having one adult polyp plus one juvenile to others comprising numerous adult and juvenile polyps and covering several cm² (Figs. 1A, B). Polyps within an aggregation loosely bound together by tubers growing from lower parts of hydrocauli (Fig. 2); tubers either thin and forming a loose, web-like mass resembling a hydrorhiza, or consisting of two or three thick, finger-like projections from base of hydrocaulus clasping around substrate and thereby anchoring polyps; mass formed by entwined tubers not very stable, such that groups of one to several hydranths easily separated; anastomosing of tubers not observed. New polyps developing either from lower part of hydrocaulus, or from thicker tubers often adjacent to an existing hydrocaulus (Fig. 3c), or sprouting from thinner tubers on hydrorhiza; less frequently, new polyps arising from outer side of perisarc of hydrocaulus, the origin of such polyps presently being unclear. Perisarc thin, transparent, often inconspicuous or lacking in upper section of hydrocaulus; empty perisarc tubes present in some parts of colony. Hydrocaulus wide, often rounded and broad at base, narrowing distally and widening slightly below aboral tentacle whorl. Dissected hydrocauli filled with more or less dense parenchymatic tissue, walls coursed by small but numerous peripheral endodermal canals (Fig. 4). Hydranths vasiform, with oral and aboral whorls of tentacles, short neck area visible below aboral tentacles (Fig. 3d); interior of hydranth with a large oral chamber above cushion of vacuolated cells. Aboral tentacles filiform, 26–40 in number in adult polyps, arranged in a narrow band made up of two or three concentric rings. Oral tentacles filiform, 50–60, arranged in five irregular whorls, shortest ones surrounding mouth. Blastostyles about 20 per hydranth, of varying lengths, usually not longer than hydranth, arising from hydranth between oral and aboral tentacle whorls. Gonophores oval, without radial canals or tentacles, arising from small pedicels on all sides of blastostyles (Fig. 3a). Female gonophores (Fig. 3b) with a few large cell masses thought to be embryos, but no actinulae found in any of a large number of gonophores examined from two different collections.

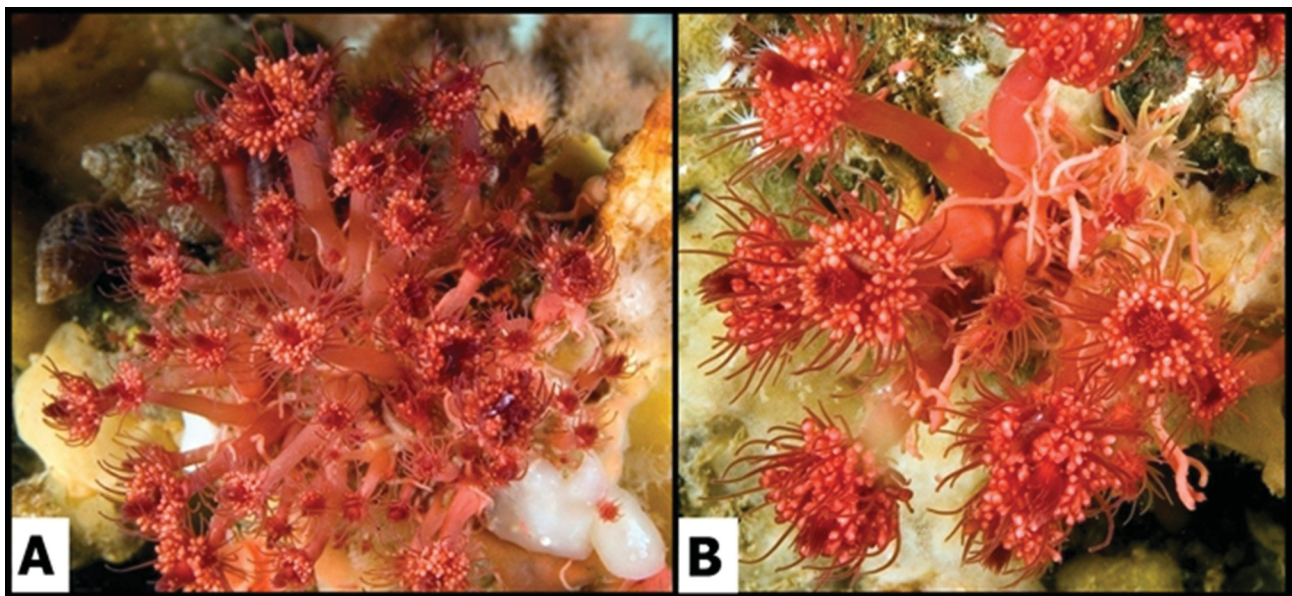


FIGURE 1. *Zyzzyzus rubusidaeus*, live aggregation of polyps, from nature. A, entire aggregation (collected 30 March 2012). B, closer view of an aggregation, showing polyps and gonophores (collected 28 February 2012). Photo by Neil McDaniel.

Cnidome (Fig. 5). Stenoteles, small (on oral and aboral tentacles, hydranth body, and gonophores; $n = 10$): $8.2\text{--}10.2 \times 6.3\text{--}8.3 \mu\text{m}$ (undischarged).—Stenoteles, large (on oral and aboral tentacles, hydranth body, and gonophores; $n = 10$): $10.9\text{--}11.8 \times 9.0\text{--}10.1 \mu\text{m}$ (undischarged).—Desmonemes (on oral and aboral tentacles, hydranth body, and gonophores; $n = 10$): $7.5\text{--}8.7 \times 6.0\text{--}7.1 \mu\text{m}$ (undischarged).—Microbasic euryteles (on oral and aboral tentacles, hydranth body, and gonophores; $n = 10$): $11.9\text{--}14.8 \times 8.1\text{--}10.0 \mu\text{m}$ (undischarged).—Basitrichs (on oral and aboral tentacles, hydranth body, and gonophores; $n = 9$): $7.0\text{--}11.3 \times 2.0\text{--}3.4 \mu\text{m}$ (undischarged).—Isorhizas, large (on hydranth body and gonophores; $n = 10$): $15.0\text{--}19.5 \times 6.9\text{--}9.0 \mu\text{m}$ (undischarged).—Isorhizas, slender (on gonophores; $n = 2$): $8.1\text{--}9.8 \times 1.6\text{--}1.8 \mu\text{m}$ (undischarged).



FIGURE 2. *Zyzzyzus rubusidæus*, adult and juvenile polyps. Scale for adult equals 0.5 mm; scale for juvenile equals 0.125 mm.

Remarks. Within the genus *Zyzzyzus* Stechow, 1921 (Petersen 1990; Campos *et al.* 2007), now comprising seven species, *Z. rubusidæus* most closely resembles *Z. robustus* Petersen 1990. Unlike in the latter species, (1) perisarc surrounding the zooid is thin and transparent rather than thick, stiff, and conspicuous, (2) aboral tentacles are scattered within a narrow band at the base of the hydranth rather than being arranged in a single whorl, (3) gonophores arise from blastostyles on simple pedicels that sometimes split only at their end instead of occurring on seven or eight very short, stout branches (Petersen, 1990: 184). Hydroids of *Z. rubusidæus* are a striking raspberry colour which fades but little in formalin, whereas *Z. robustus* is described as a “rich yellow brown” (Petersen 1990: 184). Unlike in *Z. rubusidæus*, which may grow in dense, colony-like aggregations, hydroids of *Z. robustus* and others of the genus are described as “solitary” and appear to grow in a more scattered pattern (Campos *et al.* 2007, Figs. 1a, b).

We do not know how polyp aggregations in *Z. rubusidæus* are formed, or whether each aggregation represents a clone. Juvenile polyps in our material most commonly arose either from the tubers or from proximal regions of the hydrocauli of fully-developed polyps; less often they arose from the outer layer of perisarc enveloping the hydrocaulus of larger specimens. It remains unclear, however, whether such young polyps arose by asexual

budding, by settlement of sexually-generated larval stages from the same aggregation, by settlement of such larvae from adjacent aggregations, or by a combination of these methods. It is therefore questionable whether they constitute a colony, usually defined in Hydrozoa as an assemblage of interconnected polypoid and/or medusoid individuals derived asexually from a single larval stage (Cornelius 1995; Bouillon *et al.* 2006; Nawrocki & Cartwright 2012). It is also uncertain whether they constitute “aggregated colonies” in the sense of Stepanjants *et al.* (2002), defined as an association of polyps that are loosely connected basally yet have common coenosarc.

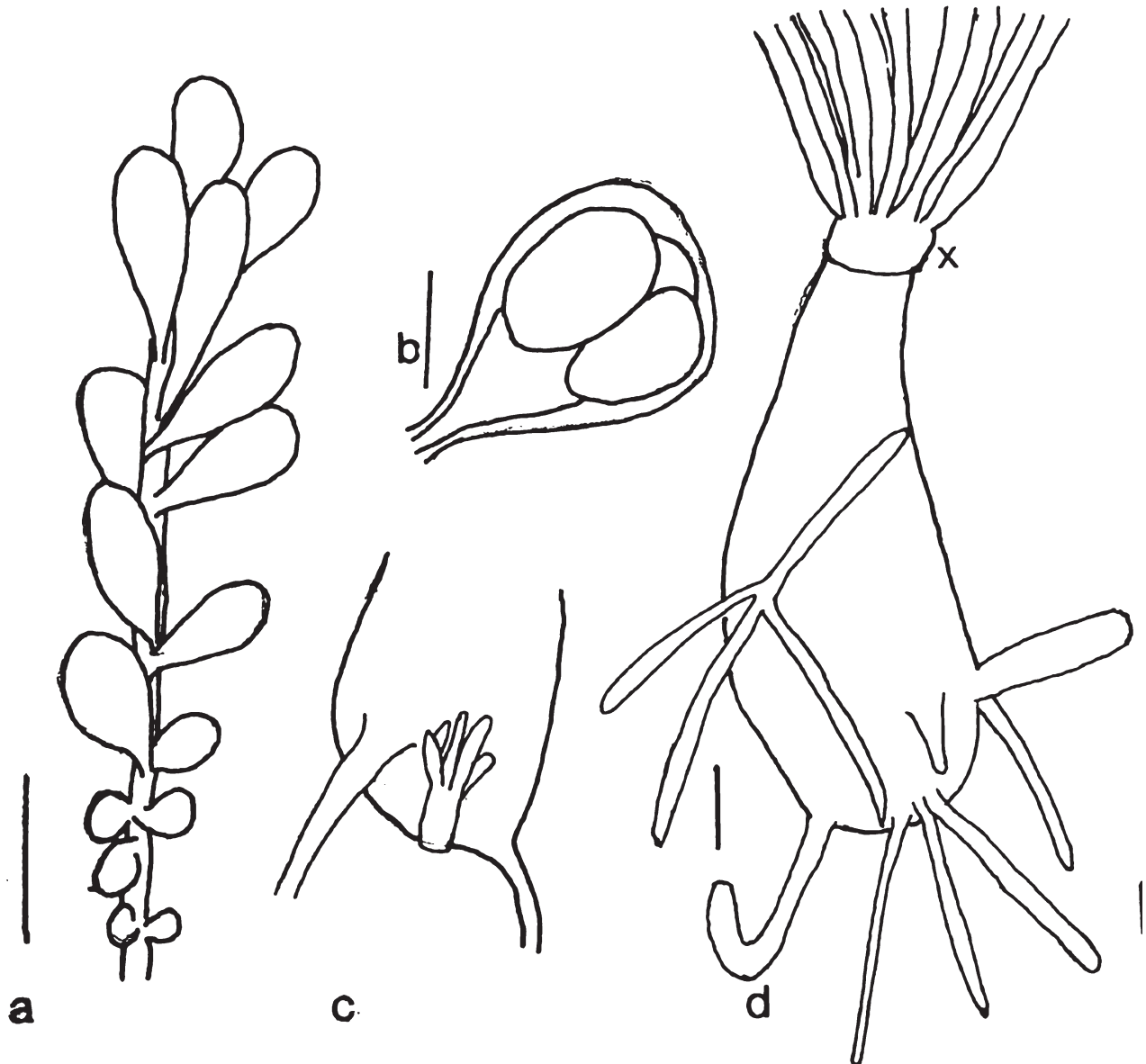


FIGURE 3. *Zyzzyzus rubusidaeus*. Diagrams of polyps. a, gonophores on blastosyle, scale 1 mm. b, female gonophores, scale 0.4 mm. c, base of hydrocaulus with two tubers and young polyp, scale 1 mm. d, smaller polyp showing neck (x) and tubers on lower part of hydrocaulus, scale 1 mm.

As noted by Cornelius (1995), zoological terminology does not yet precisely cover the variety of phenomena grouped within the term “colony.” Indeed, Nawrocki & Cartwright (2012) reported a different kind of colony formation in *Ectopleura larynx* (Ellis & Solander, 1786), a hydroid belonging to the same family (Tubulariidae) as *Zyzzyzus rubusidaeus*. Colonies in that species were formed through fusion of polyps that had been generated sexually, rather than through asexual means. However aggregations of polyps are established in *Z. rubusidaeus*, and whether they can be defined as colonies or not, observed polyp clusters in the species likely afford those adaptive advantages attributed to a colony over solitary animals on hard substrates, especially increased effectiveness in competition for space (Jackson 1977; Osman 1977; Nawrocki & Cartwright 2012).

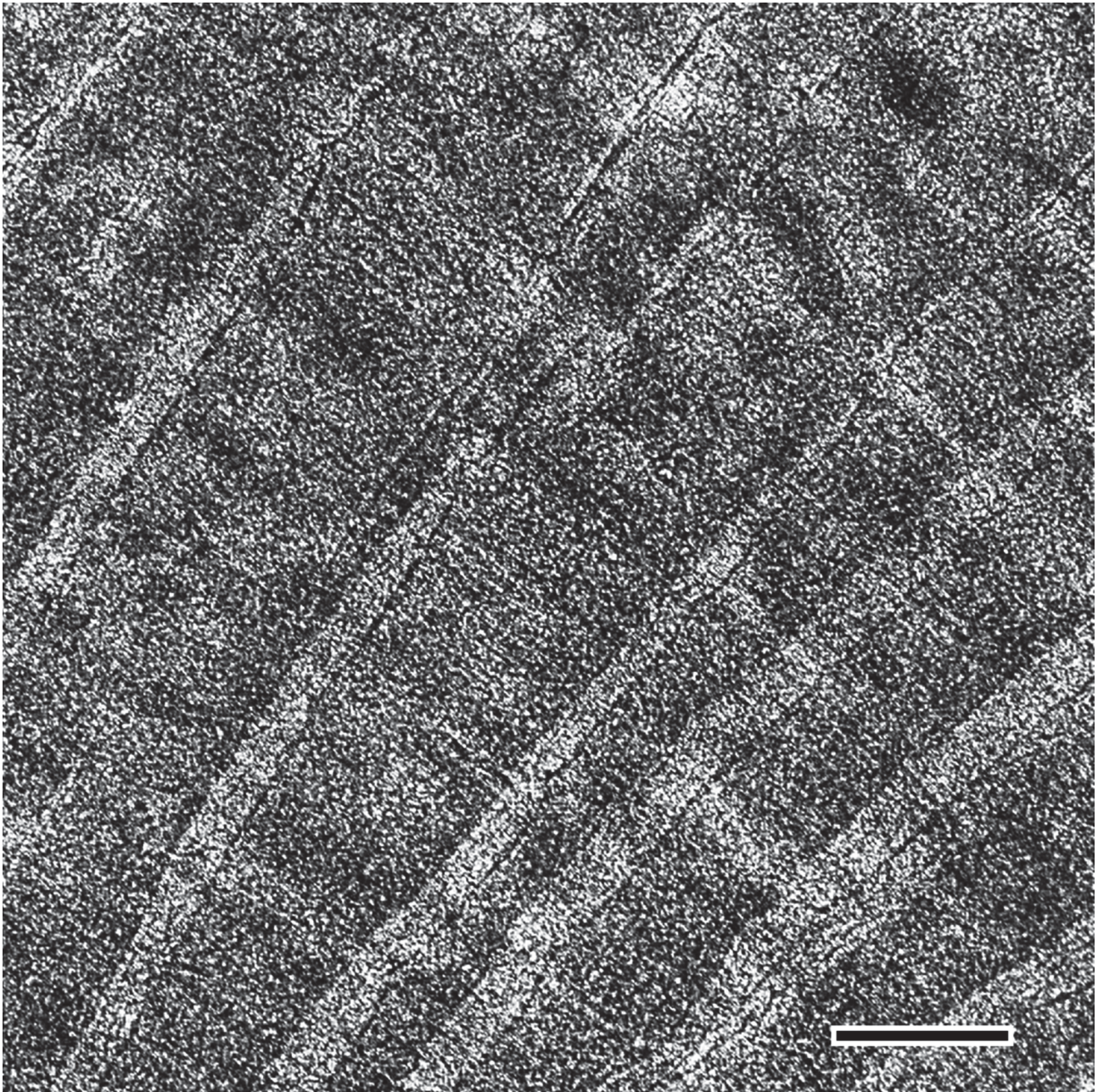


FIGURE 4. *Zyzzyzus rubusidaeus*, section of hydrocaulus showing longitudinal canals. Scale equals 0.1 mm.

Zyzzyzus rubusidaeus was first mentioned in the literature as “the raspberry hydroid” in a published abstract by Millen (1985). She noted that it was preyed upon by both an aeolid nudibranch and a stenothoid amphipod. In describing that previously unknown nudibranch, as *Cuthona punicea*, Millen (1986) noted that its prey was an “...undescribed, wine-red hydroid...” The species has been illustrated in Pacific coast guidebooks (e.g. Harbo 1999, 2011, as *Corymorpha* sp.), and it was listed, again as *Corymorpha* sp., in a work on rare and endangered invertebrate species of British Columbia (Austin 2000).

Although actinula larvae are reported in the life cycle of other species of the genus *Zyzzyzus*, we have been unable to confirm their existence in *Z. rubusidaeus*. Oval, whitish masses believed to be embryos were visible in female gonophores of our material, but their nature is still obscure (Fig. 3b).

Distribution. Although guidebooks claim the distribution of the “raspberry hydroid” (as *Corymorpha* sp.) to be from Alaska to central California, we could confirm its occurrence only for Weynton Passage in Broughton Strait, and Discovery Passage off Quadra Island (Rick Harbo, 1999, 2011 and personal information), all in British Columbia.

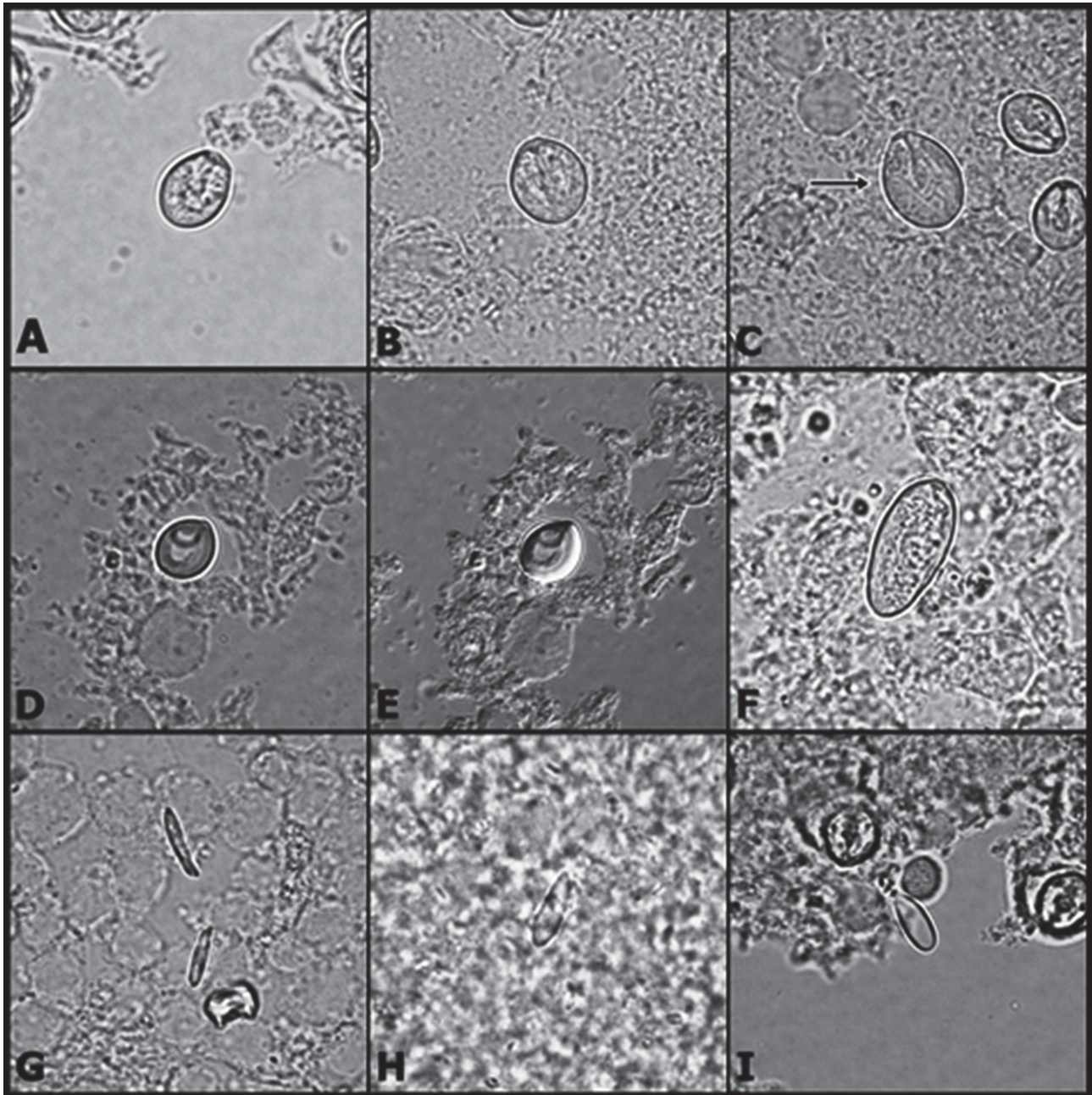


FIGURE 5. Cnidocysts of *Zyzzyzus rubusidaeus*. A, stenotele, small, from oral tentacle. B, stenotele, large, from aboral tentacle. C, microbasic eurytele, from aboral tentacle. D, desmoneme, from oral tentacle. E, desmoneme, from oral tentacle (differential interference contrast). F, isorhiza, large, from hydranth. G, isorhizas, slender, from gonophore. H, basitrich, from gonophore. I, basitrich, discharged, from gonophore.

Etymology. The Latin specific name *rubusidaeus* refers to the raspberry colour and appearance of the species, and to the common name “raspberry hydroid” frequently given to this conspicuous species (Millen 1985; Harbo 1999, 2011; Austin 2000) by biologists and divers in the vicinity of the type locality (Broughton Strait, off Vancouver Island, Canada, NE Pacific).

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